SFSU – SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

ENG 453 LABORATORY MANUAL

This Manual, downloadable from

http://online.sfsu.edu/~sfranco/CoursesAndLabs/Labs/453Labs.html

contains the pdf handouts for all lab experiments covered in Engr 453 – *Digital IC Design*. Following is a list of the various lab experiments, lasting an average of 3 weeks each:

1. **MOSFET Array Characterization**
2. **Characterization of CMOS Gates**
3. **Digital and Analog CMOS Applications**
4. **BJT Characterization**
5. **Bipolar Logic Gates**

There are also two **Appendices**, giving tips on proto-board circuit construction as well as electrical measurements, and a folder with the files associated with each of the **PSpice Examples** presented in the Manual – files that students can download to duplicate the examples on their own, if they wish to do so.

Lab #1 is devoted to the characterization – both static and dynamic – of an IC array of complementary MOSFETs

Lab #2 is devoted to the characterization of CMOS logic gates as well as CMOS transmission gates.

Lab #3 investigates a variety of digital as well as analog applications of CMOS technology: multi-vibrators, Schmitt triggers, amplification, and digital-to-analog conversion.

Lab #4 is devoted to the characterization – both static and dynamic – of a bipolar transistor.

Lab #5 is devoted to the characterization of TTL gates, both standard and low-power Schottky.

In general, a lab experiment is preceded by a detailed and self-contained review of the **theoretical background**. The experiment then proceeds with the **characterization** of the device under scrutiny as well as the investigation of some significant **applications**. The study of applications starts with **theoretical prediction** of circuit behavior using the results of the characterization, followed by **experimental verification**, followed by **computer simulation**, and it concludes with a comparison of the three approaches, with a justification of any discrepancies.

The above approach – characterization, prediction, experimentation, and computer simulation – is designed to prepare students for current industrial practice. A strong laboratory background constitutes an important asset for any student who envisions post-graduation work as a *test engineer*, a *product engineer*, an *applications engineer*, or a *design engineer*.